

Docket No.: SB-514

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

Applic. No.	:	10/533,560	Confirmation No.:	4363
Inventor	:	Gebhard Zobl, et al.		
Filed	:	May 2, 2005		
Title	:	Process for Producing a Molding		
TC/A.U.	:	1791		
Examiner	:	Russell J. Kemmerle III		
Customer No.	:	24131		

BRIEF ON APPEAL

This is an appeal from the final rejection in the Office action dated July 17, 2010, finally rejecting claims 8-12 and 14-16.

Appellants submit this *Brief on Appeal* including payment in the amount of \$540.00 to cover the fee for filing the *Brief on Appeal*.

Real Party in Interest:

This application is assigned to Plansee SE of Austria, a company of Plansee Group of Reutte, Austria. The assignment is recorded at Reel/Frame number is 017537/0123.

Related Appeals and Interferences:

No related appeals or interference proceedings are currently pending which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims:

Claims 8-12 and 14-16 are rejected and are under appeal. Claims 1-7 and 13 were canceled.

Status of Amendments:

The claims have not been amended subsequent to the final rejection.

Summary of the Claimed Subject Matter:

A concise explanation of the subject matter defined in each of the independent claims 8 and 16. The explanation below refers to the specification by page and line number, and to the drawing. The claims do not contain any means-plus-function or step-plus-function language that would require a treatment with respect to 35 U.S.C. § 112, sixth paragraph.

Independent claim 8:

A process for producing a molding with a basic body (5; Fig. 1) having a multiplicity of elevations (4, 5; Fig. 1, Figs. 2-3B) merging into the basic body (5) with inclined side surfaces, the method which comprises the following steps:

providing a powdery alloy having at least 20% by weight of chromium component (p. 6, lines 1-21; production example, p. 7, lines 9-18) and pressing the powdery alloy in a two-stage pressing operation with a first pressing stage and a second pressing stage (p. 3, lines 20-36; production example, p. 6 et seq.); and

in the first pressing stage, pressing boundary surfaces of the basic body to near final shape as far as transition regions of the elevations and simultaneously pressing the elevations to an oversize, defined with a projection height h' from the basic body being greater than a projection height h from the basic body in a finally pressed state by 10% - 150%, and with side surfaces of the elevations enclosing an angle of inclination α' in a range from 90° - 150° with a respectively adjacent boundary surface of the basic body (p. 3, lines 22-31; production example, p. 7, line 26, to p. 8, line 7), and

in the second pressing stage, pressing the elevations to near final shape, with the angle of inclination α' increased to a value α in a range from 95° - 170° (p. 3, lines 33-36; production example, p. 8, line 9, to p. 9, line 14); and

subsequently sintering the basic body to produce the molding (p. 8, bottom; p. 9, lines 12-14).

In more general terms, the claim defines a process for producing a molding that comprises a disk-like or plate-like basic body having a large number of knob-like and/or web-like elevations which merge into the basic body with inclined side surfaces. A powdery raw material is thereby pressed and sintered close to the final shape.

Independent claim 16:

A process for producing a molding with a basic body (5) having a multiplicity of elevations (4, 5; Fig. 1, Figs. 2-3B) merging into the basic body with inclined side surfaces, the method which comprises the following steps:

providing a powdery alloy having at least 20% by weight of chromium component (p. 6, lines 1-21; production example, p. 7, lines

9-18) and pressing the powdery alloy in a two-stage pressing operation with a first pressing stage and a subsequent, second pressing stage (p. 3, lines 20-36; production example, p. 6 et seq.); and

in the first pressing stage, pressing boundary surfaces of the basic body to near final shape as far as transition regions of the elevations and simultaneously pressing the elevations to an oversize (p. 3, lines 22-31; production example, p. 7, line 26, to p. 8, line 7), wherein the oversize of the elevations resulting from the first pressing stage is defined with:

a projection height h' from the basic body greater than a projection height h from the basic body in a finally pressed state by 10% - 150% (p. 3, lines 25-30); and

side surfaces of the elevations enclosing an angle of inclination α' between 90° and 150° with a respectively adjacent boundary surface of the basic body (p. 3, lines 30-33);

in the second pressing stage, pressing the elevations to near final shape, by reducing the height of the elevations from the height h' to the height h and by increasing the angle of inclination α' to a value α in a range from 95° - 170° (p. 3, lines 33-36; production example, p. 8, line 9, to p. 9, line 14); and

subsequently sintering the basic body to produce the molding
(p. 8, bottom; p. 9, lines 12-14).

Here, additional emphasis is placed on the specifics of the intermediate height h' (relative to the final height h) and the intermediate angle α' (relative to the final angle α) prior to the second pressing stage.

Grounds of Rejection to be Reviewed on Appeal:

Claims 8-12 and 14-16 are rejected as being obvious over Yoshida et al. (US 6,660,420, "Yoshida") in view of Koga (US 6,517,338) and Quadakkers et al. (US 5,733,682, "Quadakkers") under 35 U.S.C. § 103.

Argument:

Claims 8 and 16, as well as the dependent claims 9-12 and 14-15 are patentably distinct from the prior art, as represented by Yoshida, Koga, and Quadakkers. The Examiner has failed to make out a prima facie case of obviousness under 35 U.S.C. § 103.

Yoshida describes a separator for a fuel cell. The separator is produced from graphite powder. The graphite particles are bound by a

thermosetting resin. During the production of the separator body, the base mixture of the graphite and the resin is formed in a two-stage pressing process into final shape. Such a mixture is easily brought into final shape. The separator achieves its necessary rigidity and density when the resin cures at a slightly elevated temperature in the range from 150°-170°C during the second pressing stage. Yoshida explains:

[T]he preliminary molded member is then placed in a mold 14 having a predetermined final shape (step S102).

Under this state, the mold is 14 is heated to 150 to 170°C, and a pressing machine . . . producing the separator 4 having the final shape which corresponds to the shape of the mold 14 (step S104).

In the separator 4 . . . while heating the mold to 150 to 170° C. Therefore, the thermosetting resin melts and a thermosetting reaction occurs, with the result that the preliminary molded member can be uniformly molded into the separator 4 in which the mold density is high, and which has a predetermined shape.

Yoshida, col. 6, line 49, to col. 7, line 4.

Yoshida's process is entirely different from the claimed process, where powder mixtures are processed that are very difficult to press. Yoshida

presses graphite in a matrix of about 10-40% resin. Such mixtures are very easy to press and to mold. See, col. 7, lines 5-15. The powders of the claimed invention are chromium (Cr) powders. These materials are extremely difficult to press. Subsequent to the second pressing stage, the near-final-shape pressed body must be subjected to sintering so as to assure the structural rigidity and sufficient density of the article.

Appellants will not, however, rely solely on the foregoing argument. Instead, we respectfully point to the prior art reference Quadakkers, which describes the pertinent state of the art. Where complex forms such as separators (interconnectors, bipolar plates) for fuel cells are to be formed of chromium-containing alloys, there are two processes available in the art, to wit:

The typical form of the plate which can be several millimeters thick with gas channels can be manufactured by conventional machining of sheet material or it can be fabricated by a process yielding a shape close to the final form (near-net-shape process) by powder metallurgical methods (MIM, WPP).

Quadakkers, col. 3, lines 34-38. That is, where powder is used, only MIM (metal injection molding) or WPP (wet powder pouring) is available

to the person of ordinary skill in the art. The primary disadvantage of these processes is their requirement for a high content of binder. Shrinkage and/or pore formation during the subsequent sintering process cannot be avoided.

In other words, the prior art does not teach molding to near final shape in a two-stage press where chromium alloy powders are used as the starting materials. Instead, the only powder metallurgical processes that are considered are MIM and WPP.

The secondary reference Koga does not properly modify Yoshida to reach the claimed invention either. There, separators are also produced from graphite powder mixtures with a thermosetting resin, and the body is compressed to assure the required gas-tightness. According to Koga:

The separator 104 is constructed from a gas impermeable conductive member such as of a molded carbon article formed of an electrically conductive carbon material compressed for reduced gas permeability.

Koga, col. 1, lines 32-35. See, also, col. 4, lines 26-32, where Koga describes adding thermosetting resin (e.g., phenolic resin) so as to improve the molding composition.

The person of ordinary skill in art who attempts to produce an intricately shaped body with powder-based alloys and press the same into near-final shape is not guided towards the claimed invention. Instead, the artisan is unambiguously directed to MIM or WPP as the only readily suitable processes. See, also, Rule 132 Declaration, of record.

This is where appellants' invention becomes evident. The process according to the invention is based on the concept of enabling the formation of intricate shapes in a power-pressing process by providing for the detailed two-stage pressing with carefully controlled press shaping. The claimed formation of the angles and the dimensions of the elevations between the two pressing stages and the final shaping is neither shown nor suggested in the prior art. The processes using graphite powders and thermosetting resin, and the fact that such easily molded materials may be formed to the shapes and dimensions as claimed, cannot render the claimed invention unpatentable. Also, the fact that the Examiner has completely failed to provide any evidentiary support in the art that the claimed two-stage pressing with the changed angles would be obvious (or known), supports the contention that the claimed process is patentable.

Appellants respectfully submit that the combination of Yoshida, Koga, and Quadakkers can be arrived at only with “hindsight” and that the alleged obviousness of the combination is entirely artificial and finds no basis in the prior art. In order to guard against such an impermissible combination, we must review the state of the art as it existed prior to the invention. The “objective” starting point – as viewed by the person of skill in the art prior to August 1, 2002 – was as follows:

The person of skill in the art was well aware of the difficulties concerning the pressability of chromium-containing powder mixtures. The person of ordinary skill in the art would therefore – virtually by definition – proceed as was conventional in producing form parts for interconnectors of fuel cells. The person of ordinary skill in the art would necessarily have utilized the conventional processes described by Quadakkers (MIM or WPP), which do not require pressing.

The person of skill in the art would not have considered employing the special pressing processes described by Yoshida and Koga, where easily pressable graphite powder is used (which, by the way, does not require sintering after pressing) to press chromium powders (which do

require sintering after pressing). The skilled artisan would not have considered it, because success was not predictable and entirely unexpected.

Not only was there absolutely no suggestion to combine, but appellants have proven with the foregoing facts that the combination of these teachings was entirely non-obvious and there existed several obvious reasons why a person of ordinary skill in the art would not have combined the teachings.

Appellants, however, shall not rest on these conclusions. The appeal may be further focused on two primary issues. Frankly, appellants are at a loss with regard to the examiner's conclusion that the two-step molding with respectively changed draft angles should be obvious from a prior art teaching that teaches an easy-removal draft angle. Second, the final rejection raises the question whether or not the patent examiner should continue to make certain factual statements and ascribe such information to the alleged understanding of the "person of ordinary skill in the art" when appellants have provided clear proof (e.g., Rule 132 Declaration, of record) tending to show that the examiner's contentions are indeed wrong.

Increasing the Draft Angle in a Second Pressing Step:

The independent claims define a process in which an alloy powder with chromium is first pressed such that *side surfaces of the elevations enclose an angle of inclination* (i.e., a draft angle) *between 90° - 150°*. Then the elevations are further pressed with the *angle of inclination α ' increased to a value α in a range from 95° - 170°*.

The Examiner utilizes the secondary reference Koga with regard to these features. Koga states the angle of inclination of the protrusions is preferably between 91° and 100°. This is nothing more than a very basic teaching concerning the draft angle of a die mold. Depending on the material being molded, the draft angle must always exceed 90° so that the product may be safely ejected. As a rule of thumb, 0.5° is considered a minimum and several degrees may be utilized, as long as the resulting product is not adversely affected. Here, Koga's protrusions may have any single inclination angle (i.e., preferable range is 91° - 100°; an alternative embodiment has a draft angle of 105° (Fig. 6)).

Fig. 6 of Koga illustrates an alternative (!) embodiment with an increased angle of inclination, relative to the other embodiments. There

is nothing in the reference that would suggest a first pressing step with a given draft angle that is followed by a second pressing step with an increased draft angle (relative to the first draft angle).

The final rejection is based on the Examiner's conclusion that a two step pressing process "would have been obvious" from Yoshida ("with the second pressing step reducing oversized knobs") and that the angle of inclination of the knobs would be greater than 90° because of Koga.

This conclusion is not supported in the facts. The claims require an "increased" draft angle from the first to the second pressing step. There is absolutely nothing in the prior art that would suggest two different draft angles during a two-step pressing process.

Koga does indeed disclose certain draft angles of his dies and the resulting product. Again, this is rudimentary molding technology where a draft angle of greater than 90° makes it easier to release the pressed piece from the mold. Koga also invites any of a variety of angles of inclination. This is but a molding process parameter that is driven by the material and by the workpiece. Appellants do not agree, however, that either of these issues have any bearing on the question at hand.

The secondary reference simply does not suggest a two-step pressing sequence with the inclination angles as claimed.

According to the secondary reference Koga, the protrusions (6a) are either formed by way of the plate insert 2 of Figs. 1 and 5 or by way of the plate insert 2 of Fig. 6. The former plate has straight bores 2a (with a slight draft angle, as noted above), while the latter has inclined, conical bores 2a. The two embodiments represent alternatives. There is nothing in Koga – nor in any other reference, for that matter – that would suggest two different angles of inclination for the protrusions to be formed in two different pressing steps.

Expert Statement - Rule 132 Declaration:

The Examiner refuses to accept the declaration by Dr. Sigl (the “Sigl Declaration”) because, allegedly, the declaration contains conclusions regarding the ultimate issue. While it is indeed true that conclusions that go to the ultimate legal question (i.e., obvious vs. non-obvious) should not be given weight, we respectfully submit that the opinion is primarily presented with regard to factual questions and with regard to the technical understanding of those of ordinary skill in the art. Dr. Sigl

is established as an expert (items 1-5) in the pertinent field. As such, Dr. Sigl is preeminently qualified to provide “expert opinions.”

We have repeatedly stated above that the production of mold components from graphite powder is possible only with methods that cannot be compared with production techniques known from conventional (“classical”) powder metallurgy. The Rule 132 Declaration supports this argument by explaining that Quadakkers' summary that MIM and WPP would be the only prior art processes available to final shape formation of chromium alloys is correct. Sigl Dec., p. 3, top.

The production of complex moldings in conventional powder metallurgy requires that the powder mixture is first produced with a small amount of pressing aids (typically in the form of a wax) and the mixture is then pressed in dies at a very high pressure in a range of 200 to 1000 Mpa. Then the intermediate product, which has a consistency similar to chalk, is sintered at a temperature just below the melting point of the highest melting component and for a long period of time (up to one hour or even more). The part is thereby solidified and rendered largely tight.

We contrast this with the production of moldings from graphite powder. The references Yoshida and Koga represent such technology. There, the graphite powder is mixed with a large content of heat-curing resin (10-40% by weight), which renders the mixture flowable and formable. Most importantly, however, the resin is cured upon further processing, which provides the rigidity and the carrier matrix for the final product. Yoshida, col. 7, lines 5 et seq.

After the mixture is pressed in a matrix press at much lower pressures as compared with the powder metallurgy process (2-10 MPa in a first press and 10-100 MPa in a second press) – Yoshida, col. 6, lines 46 et seq. – and heated in the matrix to 150 – 170° for curing the resin, the process is finished. No sintering at high temperatures is required, as it is required in the context of the powder-metallurgical processes. Besides, such sintering would not even be possible, because the resin would vaporize and the molding would become useless because it would be entirely porous.

This foregoing juxtaposition clearly shows that the two processes – the production of moldings from graphite powder as opposed to the production of moldings from metal powders – are very different. A

person of skill in the art of powder metallurgy would not look to processes and methods known in the production of graphite powder separators and to apply such to the production of separators from chromium alloys.

We respectfully submit that the examiner has not made out a prima facie case of obviousness. The claims are patentable over the art of record. The honorable Board is therefore respectfully urged to reverse the final rejection of the Primary Examiner.

/Werner H. Stemer/

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Date: July 23, 2010

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Claims Appendix

8. A process for producing a molding with a basic body having a multiplicity of elevations merging into the basic body with inclined side surfaces, the method which comprises the following steps:

providing a powdery alloy having at least 20% by weight of chromium component and pressing the powdery alloy in a two-stage pressing operation with a first pressing stage and a second pressing stage; and

in the first pressing stage, pressing boundary surfaces of the basic body to near final shape as far as transition regions of the elevations and simultaneously pressing the elevations to an oversize, defined with a projection height h' from the basic body being greater than a projection height h from the basic body in a finally pressed state by 10% - 150%, and with side surfaces of the elevations enclosing an angle of inclination α' in a range from 90° - 150° with a respectively adjacent boundary surface of the basic body, and

in the second pressing stage, pressing the elevations to near final shape, with the angle of inclination α' increased to a value α in a range from 95° - 170° ; and

subsequently sintering the basic body to produce the molding.

- 9.** The process according to claim 8, which comprises forming the basic body as a disk-shaped or plate-shaped basic body, and forming the elevations as knob-shaped and/or web-shaped elevations.
- 10.** The process according to claim 8, which comprises forming the projection height h' by 30% - 100% greater than the final projection height h in the finally pressed state.
- 11.** The process according to claim 8, which comprises forming the angle of inclination α' within a range from 110° to 130° , and forming the angle of inclination α within a range from 115° to 160° .
- 12.** The process according to claim 8, which comprises pre-sintering subsequently to the first pressing stage.
- 14.** The process according to claim 8, wherein the alloy contains the chromium component, an iron component, and one or more additional metallic and/or ceramic alloy components of a total of at most 40% by weight, and which comprises introducing the additional alloy components into the powdery raw materials as a pre-alloy with at least one of chromium and iron.

15. The process according to claim 8, which comprises forming the molding as an interconnector of a fuel cell.

16. A process for producing a molding with a basic body having a multiplicity of elevations merging into the basic body with inclined side surfaces, the method which comprises the following steps:

providing a powdery alloy having at least 20% by weight of chromium component and pressing the powdery alloy in a two-stage pressing operation with a first pressing stage and a subsequent, second pressing stage; and

in the first pressing stage, pressing boundary surfaces of the basic body to near final shape as far as transition regions of the elevations and simultaneously pressing the elevations to an oversize, wherein the oversize of the elevations resulting from the first pressing stage is defined with:

a projection height h' from the basic body greater than a projection height h from the basic body in a finally pressed state by 10% - 150%; and

side surfaces of the elevations enclosing an angle of inclination α' between 90° and 150° with a respectively adjacent boundary surface of the basic body;

in the second pressing stage, pressing the elevations to near final shape, by reducing the height of the elevations from the height h' to the height h and by increasing the angle of inclination α' to a value α in a range from 95° - 170° ; and

subsequently sintering the basic body to produce the molding.

Evidence Appendix

A declaration under 37 CFR § 1.132 is of record in this application. The declaration was submitted on August 7, 2008 and it was entered and made of record by the Examiner.

A copy of the Rule 132 Declaration is enclosed herewith.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Gebhard Zobl, et al.
Applic. No. : 10/533,560
Filed : May 20, 2005
Title : Process for Producing a Molding
Examiner : Russell Kemmerle, III
Group Art Unit : 1791
Docket No. : SB-514
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**DECLARATION UNDER 37 CFR § 1.132
IN SUPPORT OF NON-OBVIOUSNESS**

I, Dr. Lorenz S. Sigl, do hereby declare the following:

1. I am currently employed by Plansee SE, Reutte, Austria as the head of the department "innovation services." I am an expert in the field of powder metallurgy and ceramics processing and sintering.

2. I hold a doctorate from the Montanuniversität Leoben, Austria (1985) and I researched and wrote my doctoral thesis at the Max-Planck-Institut für Metallforschung in Stuttgart, Germany (1982-1985).

3. I did post-doctoral research from 1986 to 1987 at the Materials Department of the University of California at Santa Barbara, CA.

4. I hold a post-doctorate degree in the area of structural ceramics from the Montanuniversität Leoben, Austria (1998) and I researched and wrote my postdoctoral thesis at Elektroschmelzwerk Kempten GmbH, Germany (1988-1997).

5. I have authored or co-authored to date more than (98) publications, including multiple patents, 42 articles in various int'l technical journals, 39 articles in meeting publications, and two contributions to printed books.

6. I am familiar with the disclosure, subject matter, and currently pending claims of U.S. Patent Application No. 10/533,560 (the '560 Patent Application).

7. Based on the facts set forth below, it is my professional expert opinion that the method described and claimed in the '560 Patent Application is an important contribution to the field of powder-metallurgical processing.

8. It is further my professional expert opinion that the '560 Patent Application describes and claims a valuable and beneficial process that was not previously known or obvious from the prior art.

9. For reasons set forth below, it is my opinion that the prior art of record in the patent application does not contain any teaching or suggestion that should render the claims of the '560 Patent Application unpatentable.

10. I have familiarized myself with the reference teachings Yoshida et al. (US 6,660,420, "Yoshida"), Koga (US Patent 6,517,338), and Quadakkers et al. (US 5,733,682, "Quadakkers"). I understand that the claims of the '560 Patent Application have been rejected over these teachings under 35 U.S.C. § 103.

11. Yoshida produces his separator plates from graphite powder and thermosetting resin. Graphite powder has very different properties from, and its processing characteristics are not comparable with, Fe-based powders with a high content of Cr. Furthermore Yoshida describes a two stage pressing operation which is different from the two stage pressing operation according to the '560 Patent application.

Yoshida cold presses the complete separator in a first pressing stage into a shape similar to a final molded shape. In a second pressing stage Yoshida presses the complete separator to the final molded shape.

According to the '560 Patent application in a first pressing stage only the basic body as far as the transition regions of the elevations of the interconnector is pressed to the final shape and in a second pressing stage the elevations are pressed to the final shape whereby the angle of inclination of the elevations is increased. There is no suggestion from Yoshida to press a separator in such a way.

12. Quadakkers describes separators (interconnectors, bipolar plates) for fuel cells that are formed of chromium-containing alloys. As mentioned by Quadakkers, the state of the art knows of two processes that allow forming of chromium-containing alloys to near-final-shape, namely, MIM (metal injection molding) and WPP (wet powder pouring). It is my professional opinion that Quadakkers describes the prior art correctly. In other words, those of skill in the pertinent art had at their avail only MIM and WPP as the available processes for molding Cr alloy powders to near-final shape.

13. Koga pertains to graphite powder processing as well. Koga would not be considered pertinent by one of skill in the art concerned with Cr-alloy processing and particularly not with pressing high-Cr content powders to near final shape. Graphite powders and Cr-powders behave entirely differently in the context of press compaction.

14. Persons of ordinary skill in the art of powder metallurgy would not have used a known pressing method to form interconnectors or similar moldings with a complex shape in a near final shape from alloys with a high Cr-content, i.e. > 20 % by mass. As represented in DIN 30910, iron-based sintered steels (stainless) are formed with a Cr content of 16 – 19 % by mass (AISI 316, AISI 430) or of 11 – 13 % (AISI 410). The resulting structural parts are porous parts including highly porous components such as filters, see DIN 30910, part 2 (*sintered metals for filters*), part 4 (*materials for structural parts*). High-density sintered metals or hot-forged sintered steels for structural parts, however, are specified with a Cr content of 0.1 – 0.25 % by mass, see, DIN 30910, part 6 (*sinter-forged steels*)

15. It is my professional opinion that the specifications of DIN 30910 explicitly teach that a Cr content of, say, 16 – 19 % by mass results in a structural part with a high degree in porosity (pore diameter of 10-80 µm, DIN 30910, part 2). A resultant structural part cannot be used as an interconnector for a fuel cell.

16. It is also my professional opinion that, according to DIN 30910, structural parts with a requisite high density such as an interconnector for a fuel cell can only be sinter-forged with known methods from powders having a Cr content of no more than 0.25 % by mass.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-referenced application or any patent issuing thereon.

July 23, 2008
Date

Lorenz S. Sigl
Dr. Lorenz S. Sigl

Related Proceedings Appendix

No prior or pending appeals, interferences or judicial proceedings are in existence which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal. No copies of decisions rendered by a court or the Board are being submitted.